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(54) **Self-pressurizing sprayer.**

(57) A portable sprayer which has a resealable lid (14;151)and a one-way valve (24;110) attached to a receptacle (12;101). As the receptacle is filled with fluid through the one-way valve, air which is entrapped in the receptacle pressurizes the container to facilitate dispensing the fluid.

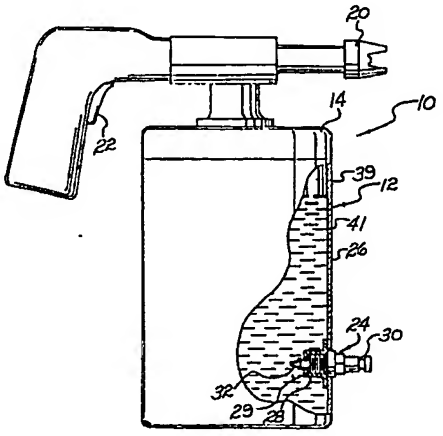

Fig. 6

EP 0 275 218 A2

Description

Self-Pressurizing Sprayer

This invention relates to sprayers, particularly small, portable sprayers which are often used around homes or in light industrial applications. Such sprayers and liquid dispensers require manual pressurization before the liquid therein can be dispensed. After filling to a designated line with water, a chemical solution or other liquid to be dispensed, the sprayer is pressurized by a hand pump prior to dispensing. Such hand pump pressurized sprayers have been the industry standard for small, portable sprayers for many, many years.

Acording to one aspect of the present invention, a portable spray for dispensing liquids under pressure comprising a closed receptacle for containing liquids under pressure, the receptacle including a dispensing outlet operably connected to dispensing valve means which can be opened to dispense liquid under pressure or closed to seal the container is characterised by a one-way valve extending from outwardly of the receptacle to inside the receptacle, the one-way valve being adapted for connection to a source of liquid under pressure and comprising means for allowing entry of the liquid into the receptacle while preventing backflow out of the receptacle, whereby the receptacle is pressurized during entry of the liquid into the receptacle when the dispensing valve means is closed.

According to another aspect of the present invention, a method of dispensing a liquid in a portable sprayer comprises the steps of: a) providing a portable receptacle having a dispensing outlet operably connected to dispensing valve means which can be opened to dispense liquid under pressure or closed to seal said receptacle, and a one-way valve; b) closing said dispensing valve means to entrap air within said receptacle; c) connecting said one-way valve to a source of liquid under pressure; d) introducing said liquid under pressure into said receptacle through said one-way valve whereby said entrapped air pressurizes said liquid within said receptacle; and e) dispensing said liquid through said receptacle dispensing outlet with said entrapped air constituting propellant means for dispensing said liquid.

Thus, the sprayer of the present invention is fitted not only with valved dispensing means as is common for such sprayers, but also with a one-way valve adapted for connection to a pressurized source of the liquid to be dispensed from the sprayer. Thus, filling the sprayer with the liquid simultaneously serves to pressurize the sprayer. For example if water is to be sprayed, a hose connected to the building or home water system can be coupled to the one-way valve so that as the sprayer is filled with water, the pressure of the home or building system is conveyed to the sprayer itself. If desired, chemicals can be introduced into the sprayer ahead of the water or other diluent to be added under pressure so that a desired solution can be dispensed with the sprayer.

The invention may be carried into practice in various ways but one self-pressurizing sprayer and a method of dispensing liquid in acordance with the the invention will now be described by way of example with reference to the accompanyhing drawings, in which:

Fig. 1 is a perspective view of a one-way valve which can be used in the sprayer of this invention;

Fig. 2 is an end view of the valve as seen from plane II-II of Fig. 1;

Fig. 3 is a cross-sectional view taken along plane III-III of Fig. 1;

Fig. 4 is an elevational view of one embodiment of a sprayer in accordance with the present invention with the top removed and portions broken away for illustrative purposes;

Fig. 5 is an elevational view similar to Fig. 4 showing the top closed and the container being filled with diluent under pressure;

Fig. 6 is an elevational view showing completion of the filling step;

Fig. 7 is an elevational view showing the sprayer in action;

Fig. 8 is a perspective view of an alternative embodiment sprayer made in accordance with the present invention;

Fig 9 is a fragmentary, cross-sectional view taken generally along plane IX-IX of Fig. 8;

Fig. 10 is a partially broken view of the Fig. 8 sprayer being filled with liquid under pressure;

Fig. 11 is a cross-sectional view of an alternative embodiment fill valve;

Fig. 12 is a cross-sectional view of the valve of Fig. 11 after a predetermined pressure level has been achieved within the sprayer; and

Fig. 13 is a cross-sectional view of yet another alternative embodiment fill valve for use in the present invention.

Referring now to Figs. 4-7, there is shown a self-pressurizing sprayer 10 which includes a receptacle 12 formed of polyethylene or the like and a closure cap 14 which may be removably secured to receptacle 12 by threads 18. Cap 14 includes as an integral part thereof a spray nozzle 20 which communicates with the fluid contained in receptacle 12 and a trigger 22 which opeates a valve (not shown) to allow fluid under pressure to be dispensed through the nozzle.

Receptacle 12 includes a filling check valve 24 mounted in receptacle sidewall 26. Check valve 24 prevents chemical solutions within receptacle 12 from backfilling into a hose or the like being used to fill receptacle 12 with liquid. This is particularly important where the liquid is water being supplied by the home water system. Receptacle 12 includes a mounting bracket 28 secured to the inner part of receptacle sidewall 26. A male quick connect coupler 30 of conventional construction is threadably secured to bracket 28 and sealed receptacle 12 against fluid leakage through check valve 24 to the outside. A duck bill valve 32 seen in Figs. 1-3 is

secured between bracket 28 and coupler 30 as shown in Figs. 4-7. Duck bill valve 32 is preferably a single piece one-way valve which includes a continuous base foot 34 and a body 36. Valve body 36 includes walls 37 of generally converging cross-sectional shape shown in Fig. 3 and terminates in a slit outlet 38. Because of the converging body walls 37, fluid under pressure may travel through slit outlet 38 only in the direction of arrow 40 but may not enter valve body 36 from the other direction.

Figs. 4-7 illustrate the sprayer in use. First, closure cap 14 is removed and receptacle 12 filled with a quantity of a substance such as concentrated liquid or solid powdered chemicals 37a (Fig. 4). Receptacle sidewall 26 may include indicator lines (not shown) to inform the user when the correct level has been reached. Clsoure cap 14 is then sealed, and a hose 42 is connected for delivery of diluent (in this case water) to receptacle 12 by a female quick connect coupler 44 which is snap-fitted over male quick connect coupler 30. Fluid under pressure is charged through hose 42 and through one-way valve 32 (Fig. 5) into receptacle 12, and compresses the air 39 which previously occupied the receptacle. After filling to a predetermined level, hose 42 is disconnected (Fig. 6) from the receptacle 12. As shown in Fig. 7, sprayer 10 may then be utilized to deliver the fluid 41 in receptacle 12 under pressure to an outside source with the compressed air in the receptacle acting as the propellant. Receptacle 12 or closure cap 14 may include a closable port (not shown) for recharging the fluid in the receptacle when the compressed air propellant is exhausted.

The alternative embodiment sprayer 100 (Fig. 8) is of a somewhat larger, though still portable, variety. It comprises a moulded plastic container 101, preferably moulded of polyethylene, which includes an integrally moulded, threaded valve seat 102 for receiving a one-way valve assembly including one-way valve 110 an a quick disconnect hose coupler 120 (Figs. 8 and 9). Container 101 also includes an integrally moulded outlet fitting 103 to which delivery tube 130 is secured and an integrally moulded threaded top opening 104 upon which the closure and hand pump assembly 150 is threadably mounted (Figs. 8 and 10).

One-way valve 110 is made of a flexible rubber and comprises an annular shoulder 111 which surrounds and projects radially outwardly from a central, cylindrical body 112. Cylindrical body 112 projects in one direction away from shoulder 111 defining a relatively large inlet opening and then terminates in a duck bill flap arrangement 113 at approximately its juncture with that side of annular shoulder 111 from which it projects. Duck bill flaps 113 define a slit opening 114 therebetween where they come together. The cross section of converging flexible rubber walls 113 is sufficiently thin that they will flex apart slightly to allow fluid to flow therethrough in one direction, but will be compressed together so as to close slit 114 under back pressure within container 101. There is an annular recess 115 in shoulder 110 which surrounds duck bill flaps 113, thereby giving them additional flexibility for proper closure against the movement of fluids in the wrong direction through slit opening 114.

Duck bill valve 110 is seated within the recess defined by valve seat 102 and is held in position by threading hose coupler 120 into the integrally formed threads in valve seat 102. The threaded, cylindrical end 121 of quick disconnect hose coupling 120 seats on top of shoulder 111 of valve 110 and thereby traps it in position against the base wall of valve seat 102.

Quick disconnect hose coupler 120 is of a conventional quick disconnect configuration. It is adapted for quick disconnect mating to a quick disconnect coupler 125 which can be threaded onto the end of a conventional garden hose or the like 126 (Fig. 10).

Preferably, one-way valve 110 and hose coupler assembly 120 are positioned in the top wall 101a of container 101. This makes it easier to connect hose 126 via coupling 125 in that one can press downwardly against coupler 120 while container 101 is resting on the ground or other firm surface. If coupler 120 were located in the side of container 101, the user would have to hold container 101 against movement while pressing hose 126 and coupling 125 onto coupler 120.

In all other respects, the alternative embodiment sprayer 100 is conventional. The flexible delivery tube 130 is clamped over the integrally moulded outlet fitting 103 by means of a tube clamp 131. The other end of flexible deliver tube 130 is secured to a spray wand 140 which includes a spray nozle 141 at one end and a valve assembly 142 at the other end.

The hand pump assembly 150 includes a threaded closure 151 and is threaded over the threaded top opening 104 of container 101. A pump handle 152 includes an elongated groove integrally formed therein so that the wand 140 can be seated in the groove for storage and transport. The handle 152 can be released for pumping to facilitate hand pressurization of container 101, or it can be locked in a down position to serve as a carrying handle for sprayer 100. Sprayer 100 can also be carried by the user over his shoulder by means of a carrying strap 160 suitable fastened to container 101.

The hand pump assembly 150 serves not only as a closure for receptacle 101, but also makes it possible to repressurize receptacle 101 when the user is remote from the source of liquid under pressure which is being used. Thus a homeowner spraying chemicals on his lawn might be at a remote location from the hose and still have some chemical solution remaining in container 101. He can simply use hand pump 150 to repressurize receptacle 101 and finish using the solution therewithin.

To pressurize container 101 of sprayer 100, hose 126 connected to a pressurized source of the liquid to be sprayed is coupled to quick disconnect coupler 120 by means of its mating quick disconnect coupler 125. Coupler 125 is preferably of the conventional type which automatically allows the fluid under pressure to pass when it is coupled to coupling 120. If the fluid is water and one desires to spray a solution of chemicals, the chemicals are first introduced into container 101 through top opening 104 by simply unthreading top closure 151 and

removing pump/handle assembly 150. With the solid or liquid chemicals introduced into container 101, closure 151 is again threaded onto threaded top opening 104 and hose 126 is coupled as described above.

Typically, container 101 will be filled with water coupled to a house or industrial water system. Usually, the pressure of such water is a fairly predictable 415 to 485 kPa (60 to 70 psi). However for use in conjunction with higher pressure systems or systems where the pressure may fluctuate, an alternative embodiment, automatic shut off valve assembly 200 is provided (Fig. 11 an 12) in place of one-way valve 110 and hose coupler 120. In this embodiment, the integrally moulded valve seat 102 of container 101 does not include internal threads. Rather, it includes an upwardly projecting, integrally moulded sleeve 102a having integrally moulded external threads upon which can be threaded a valve closure cap 201. Valve closure cap 201 includes a central opening which telescopingly receives a hose coupling stem 202, which includes a central fluid flow passage 203. Passage 203 terminates at the bottom in a lateral passage 204 which in turn feeds into an annular passage 205 around the base of coupling stem 202. Annular passage 205 is defined by a pair of annular shoulders 206, 207 projecting from the base of coupling stem 202 on either side of annular passage 205. Each annular shoulder 206 and 207 includes a groove formed therein for receiving top and bottom O rings 208 and 209 respectively.

Positioned between telescoping coupling stem 202 and the interior wall of externally threaded sleeve 102a is a sleeve 210 having an outwardly radiating top flange 211 which seats on the top edge of threaded sleeve 102a and is held in place by top threaded closure 201. Sleeve 210 includes a plurality of vertical grooves or passages 212 which extend from the bottom of sleeve 210 upwardly a portion of the distance towards the top thereof. When telescoping coupling 202 is in the position shown in Fig. 11, annular passage 205 is in flow communication with vertical groove passages 212. This allows fluid under pressure to flow in through central passage 203, lateral passage 204, annular passage 205 and downwardly through vertical passageways 212 into the space below telescoping coupling stem 202. From thence fluid can flow through the opened top of a one-way duck bill valve 110a which is very similar to duck bill valve 110 previously described. One-way duck bill valve 110a is held in position by means of a washer 230 seated over shoulder flange 111 of valve 110a and held down by the lower terminal end of sleeve 210. Washer 230 includes upwardly projecting dimples 231 which insure that there will be a fluid flow passage between the bottom of telescoping stem 202 an the top of washer 230 even when telescoping stem 202 is in its bottom most position as shown in Fig. 11, thereby allowing fluid to flow over washer 230 and into the opened top of duck bill valve 110a.

Coupling stem 202 is biased downwardly into the position illustrated in Fig. 11 by means of a coil spring 220 extending between the undersurface of the top of closure 201 and the upper surface of upper annular shoulder 206. However when back pressure begins to build up at the base of telescoping coupling stem 202, stem 202 is forced upwardly until, when it is in the position illustrated in Fig. 12, annular passage 205 is sealed from vertical groove passages 212 by means of the bottom O ring 209 in bottom annular shoulder 207. This prevents any further flow of fluid into container 101 and prevents container 101 from being over pressurized. Typically, coil spring 220 will be selected such that a back pressure of between 415 and 485 kPa (70 and 80 pounds) will close valve assembly 200 and prevent further pressurization of container 101.

Fig. 13 illustrates a one-way valve alternative to the use of duck bill valve 110 or 110a. Basically, duck bill valve 110 is replaced by a poppet valve 300 combined with a flow maintaining valve stop 310. Poppet valve 200 is axially movably received within the internal passage 124 of hose coupler 120 and flow maintaining valve stop 310 is held in place in the base of valve seat 102 by hose coupling 120 being threaded into valve seat 102 over valve stop 310.

Poppet 300 includes a stem 301 comprised of intersecting flanges, giving it an "X" shaped cross section which keeps poppet 300 properly orientated as it moves within passage 124, but still allows water to flow around stem 301. It is made of rubber with a Shore A durometer of 65-90, preferably 80±5.

Stem 301 is connected to the valve head 302 which includes a cone shaped upper surface 302 defining a valve seat. Head 302 is larger in diameter than the base of passageway 124 so that it seats on the base of passage 124 and blocks the flow of liquid or air therethrough.

The base of passage 124 opens into a larger chamber 124a at the base of hose coupler 120. Poppet head 302 is larger in diameter than passage 124, but is not as large in diameter as the internal diameter of chamber 124a. Ribs 303 project radially from the perimeter of head 302 to help keep poppet 300 centred by their engagement with the walls of chamber 124a, without blocking the flow of fluid around head 302.

Head 302 includes a flat bottom 302b which, when one connects hose coupler 120 to a source of fluid under pressure, gets forced down and seats on top of valve stop 310.

Valve stop 310 comprises basically a shoulder washer having an annular projecting shoulder 311 projecting radially from a main cylindrical body 312 which includes a central opening 313 extending therethrough in alignment with the opening in the base of valve seat 102. A plurality of radial channels 314 are cut into the top of the main cylindrical body 312 and communicate with central opening 313 so that even when the bottom 302b of valve head 302 is seated on top of valve stop 310, water can flow around valve head 302, past radiating ribs 303, through channels 314 and into passageway 313, thereby allowing fluid to flow into the interior of container 101. On the other hand once container 101 is pressurized and the source of pressurized fluid is uncoupled from hose coupler 120, pressure within container 101 will push poppet 300 upwardly so that the conical upper surface 302a of its head 302 seats

against the base of coupler passageway 124, thereby preventing the flow of air or liquid back around valve head 302 to the exterior of container 101.

Claims

1. A portable sprayer for dispensing liquids under pressure, the sprayer comprising a closed receptacle (12;101) for containing liquids under pressure, the receptacle including a dispensing outlet operably connected to dispensing valve means which can be opened to dispense liquid under pressure or closed to seal the container; characterised by a one-way valve (24;110; 110a; 200; 300) extending from outwardly of the receptacle to inside the receptacle, the one-way valve being adapted for connection to a source of liquid under pressure and comprising means for allowing entry of the liquid into the receptacle while preventing backflow out of the receptacle, whereby the receptacle is pressurized during entry of the liquid into the receptacle when the dispensing valve means is closed.

2. A sprayer according to Claim 1 in which the one-way valve includes a quick disconnect fitting (30; 120) operably connected thereto whereby the liquid under pressure can be readily quick connected and quick disconnected to the quick disconnect fitting.

3. A sprayer according to Claim 2 in which the container has a top wall (101a) and the one-way valve, including the quick disconnect fitting (125), is located in the top wall.

4. A portable sprayer according to Claim 1 or Claim 2 or Claim 3 in which the receptacle includes a resealable closure (14; 151) which can be opened to allow the insertion of chemicals into the container and then reclosed and resealed to allow pressurization through the introduction of the liquid under pressure.

5. A sprayer acording to any of Claims 1 to 4 which includes hand pump means (150) whereby the sprayer can alternatively be pressurized.

6. A sprayer according to Claim 5 which includes a pressure limiting valve (200) operably associated with the one way valve (110a) for limiting the extent to which the receptacle can be pressurized.

7. A sprayer according to any of Claims 1 to 6 in which the one-way valve (24; 110; 110a) includes an intake bore closed at one end by inwardly converging flexible walls defining a slit opening into said receptacle whereby liquid will flow from said bore through said slit, but whereby back pressure in said receptacle collapses said flexible walls toward one another preventing the escape of air under pressure through said slit.

8. A sprayer according to any of Claims 1 to 6 in which said one-way valve (300) comprises a poppet valve axially movably located within said quick disconnect fitting for movement between an open position allowing fluid to flow therepast and a seated closed position preventing flow out of said container when pressurized.

9. A sprayer comprising a receptacle having a resealable closure allowing one to open said closure and introduce chemicals or the like into said receptacle; and a dispensing outlet operably connected to dispensing valve means which can be opened to dispense liquid under pressure or closed to seal said container; characterised by a one-way valve connected to a source of liquid, said valve comprising means for allowing entry of said liquid into said receptacle while preventing backflow out of the receptacle to thereby trap and pressurize the air in said receptacle during entry of said liquid into said receptacle, whereby said liquid will be dispensed through said dispensing valve when said dispensing valve is opened.

10. A sprayer according to Claim 9 which includes hand pump means (150) whereby said sprayer can alternatively be pressurized by means of said hand pump means.

11. A method for dispensing a liquid in a portable sprayer which comprises the steps of: a) providing a portable receptacle having a dispensing outlet operably connected to dispensing valve means which can be opened to dispense liquid under pressure or closed to seal said receptacle, and a one-way valve; b) closing said dispensing valve means to entrap air within said receptacle; c) connecting said one-way valve to a source of liquid under pressure; d) introducing said liquid under pressure into said receptacle through said one-way valve whereby said entrapped air pressurizes said liquid within said receptacle; and e) dispensing said liquid through said receptacle dispensing outlet with said entrapped air constituting propellant means for dispensing said liquid.

12. A method according to Claim 11 which includes placing a concentrated chemical in the receptacle prior to step b).

13. A method according to Claim 11 or Claim 12 in which step c) includes connecting the one-way valve to a home water source through a hose (42; 126) and hose coupling (30; 125).

14. A method according to Claim 11 or Claim 12 or Claim 13 in which step d) includes disconnecting the hose (42; 126) from the one-way valve (24; 110; 110a; 200; 300) prior to dispensing the liquid.

15. A method according to any of Claims 11to 14 which includes additionally providing said receptacle with hand pump means (150), and repressurizing the receptacle by pumping the hand pump means when the pressure created as a result of introducing the liquid under pressure into the receptacle has dissipated.

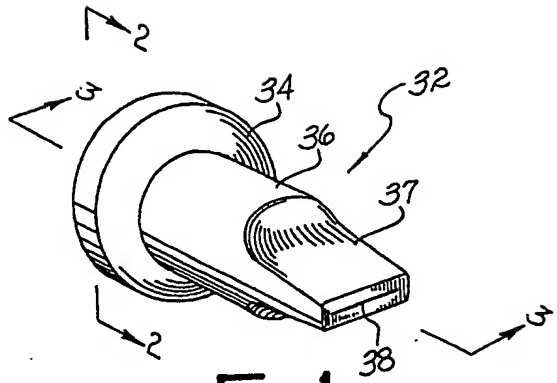

Fig.1

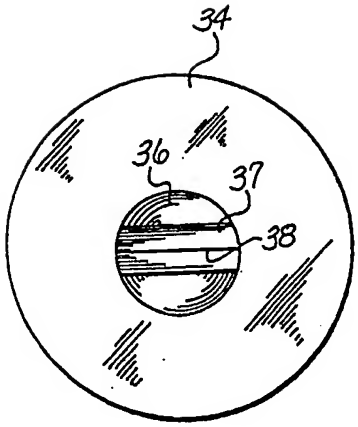

Fig.2

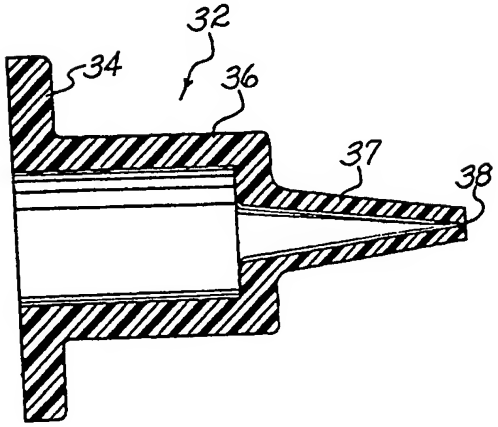

Fig. 3

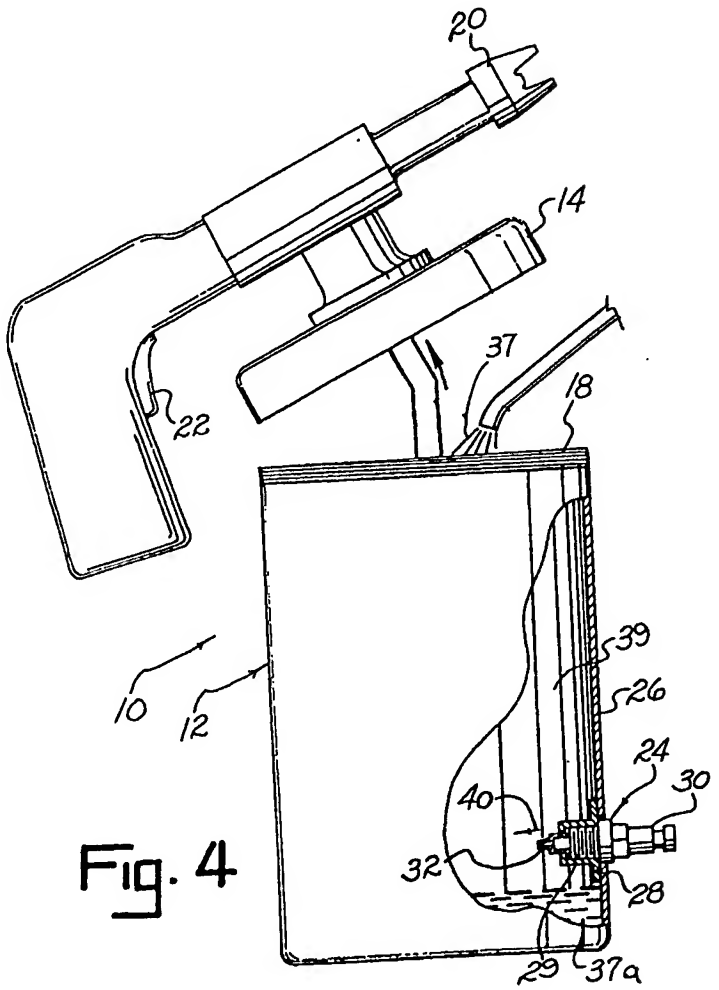

Fig. 4

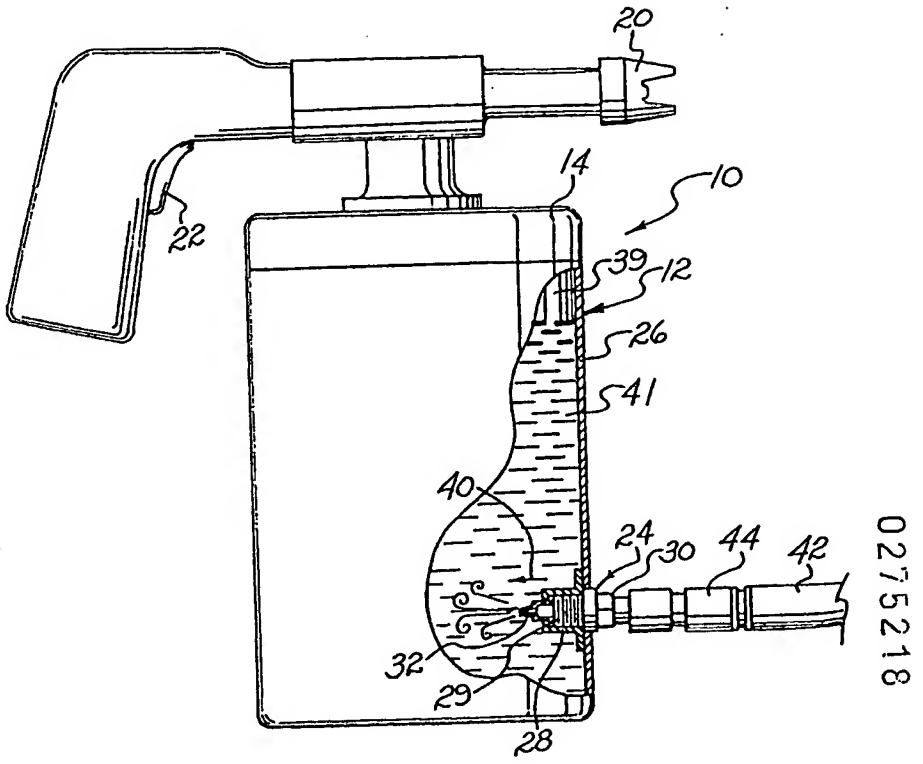

Fig. 5

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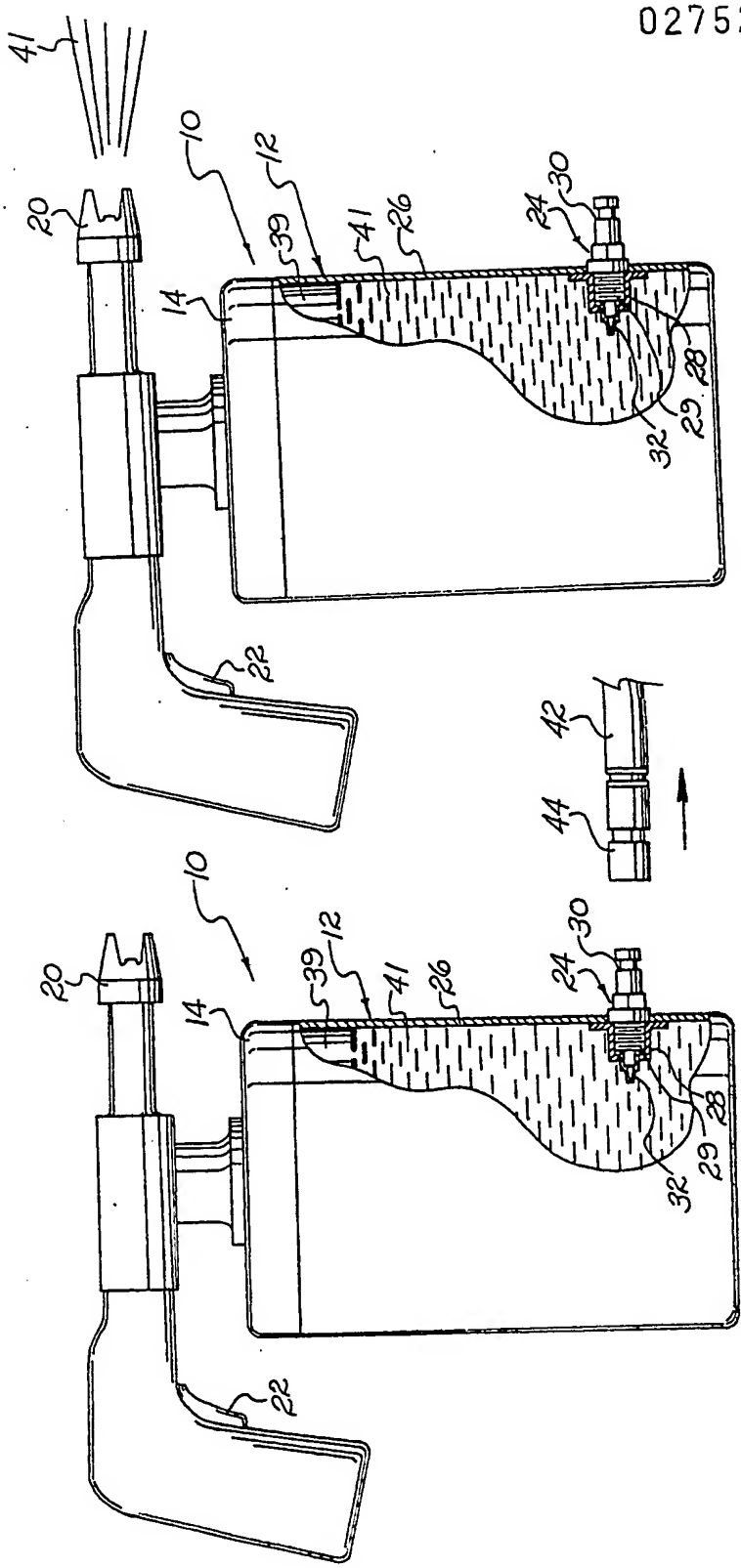
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Fig. 7

Fig. 6

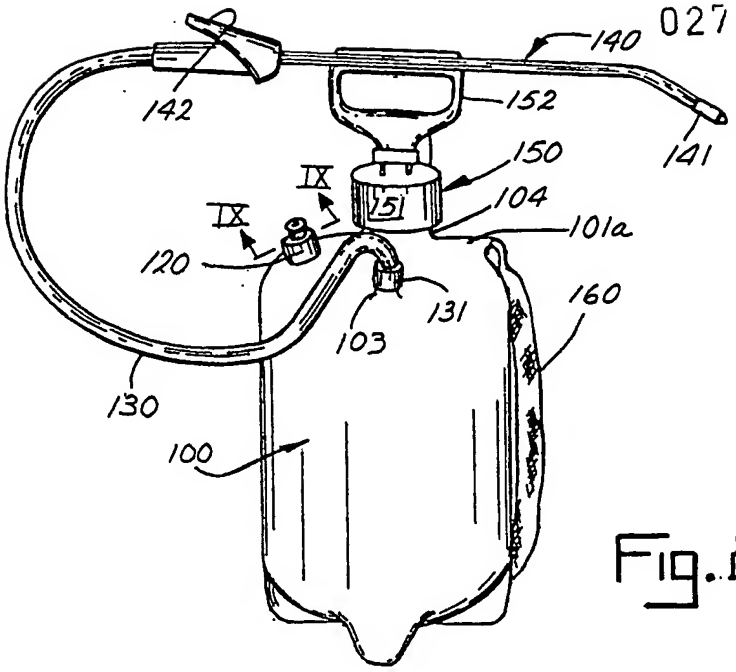
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Fig. 8.

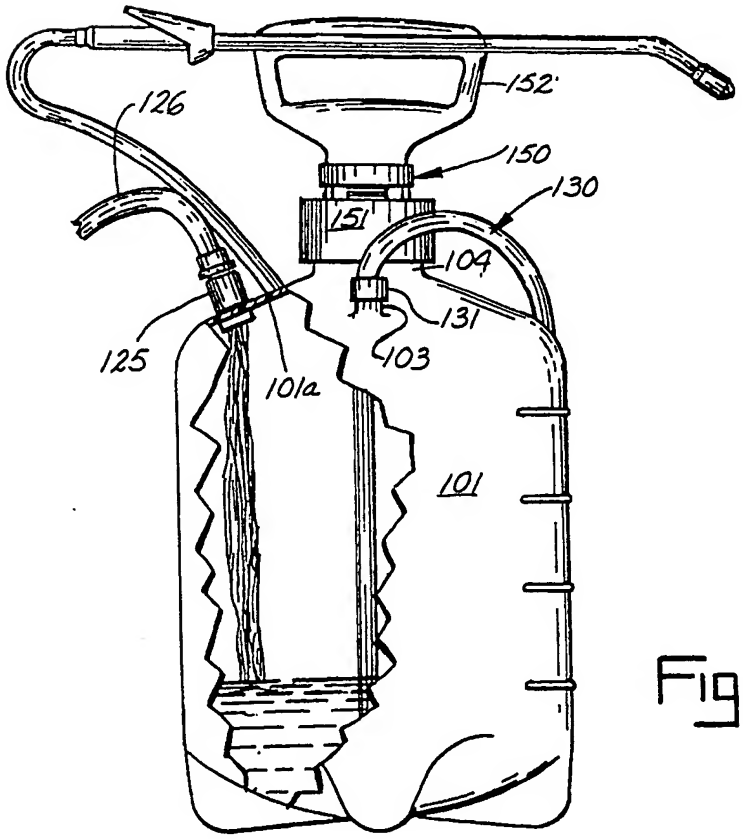
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Fig. 10.

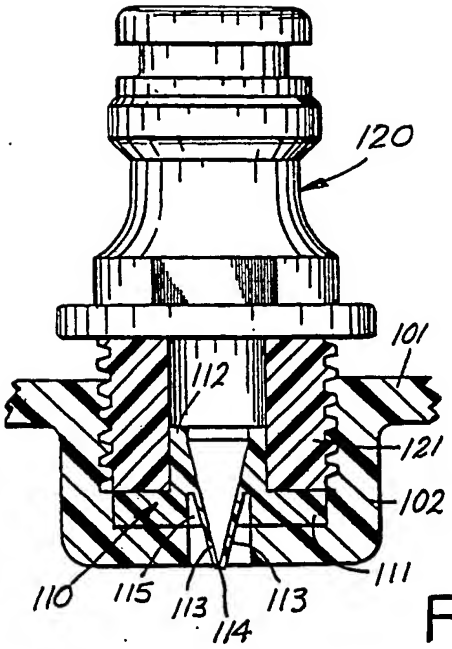
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Fig. 9.

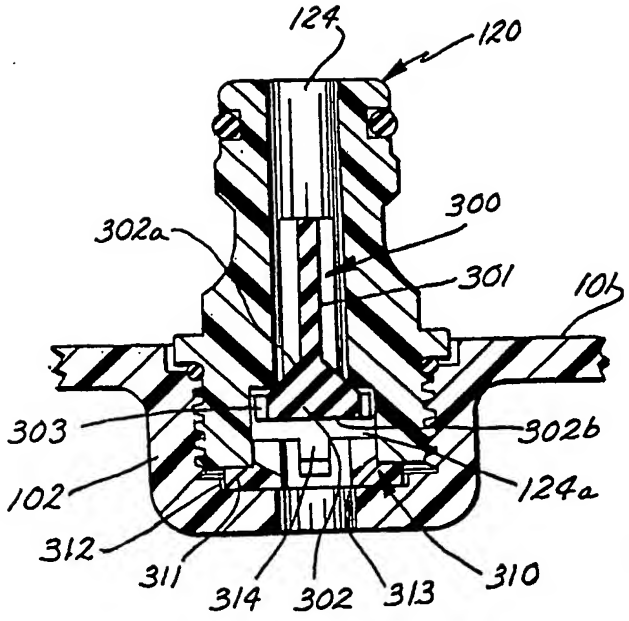
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Fig. 13.

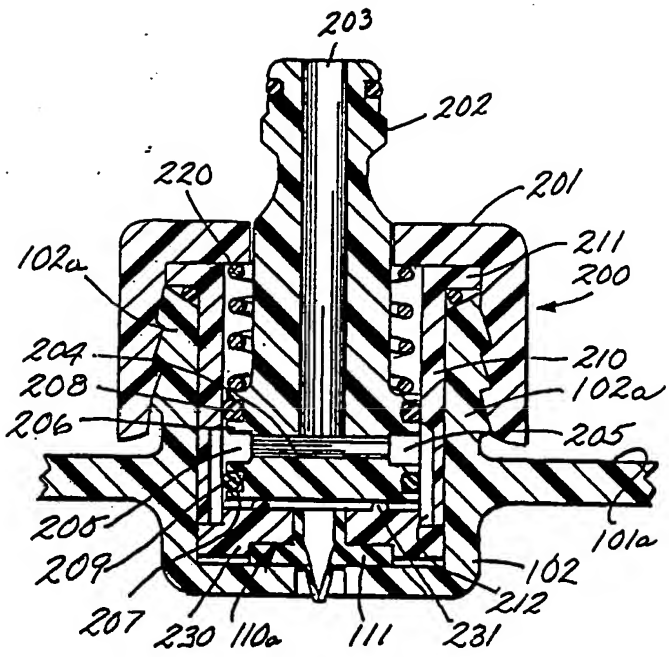
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Fig.11.

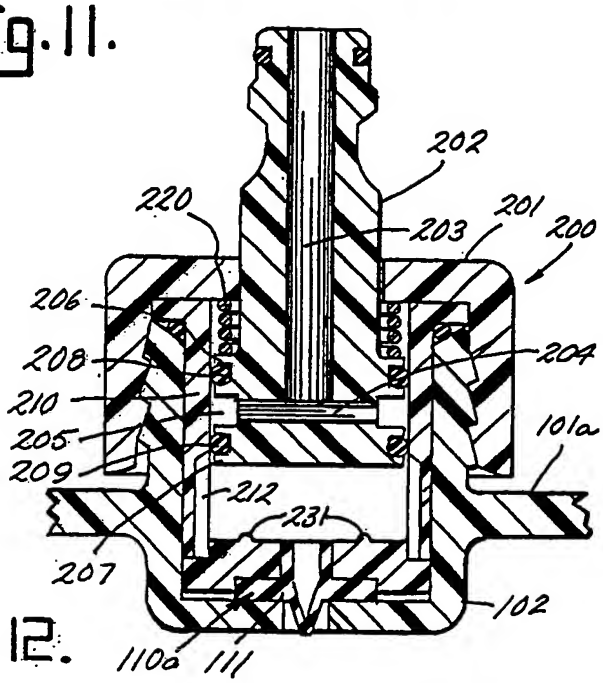
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Fig.12.